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Abbreviations:

BBzP:	Butyl benzyl phthalate.
CDC:	Centers for Disease Control and Prevention.
DBP:	Di-n-butyl phthalate.
DEHP:	Di-2-ethylhexyl phthalate.
DEP:	Di-ethyl phthalate.
HSPH:	Harvard School of Public Health.
ICCs:	Intra-class correlation coefficients.
LOD:	Limit of detection.
MBP:	Mono-butyl phthalate.
MBzP:	Mono-benzyl phthalate.
MCHP:	Monocyclohexyl phthalate.
MEHP:	Mono-2-ethylhexyl phthalate.
MEP:	Mono-ethyl phthalate.

MGH: Massachusetts General Hospital.

MINP: Mono-3-methyl-5-dimethylhexyl phthalate.

MMP: Mono-methyl phthalate.

MOP: Mono-n-octyl phthalate.

PVC: Polyvinyl chloride.

SAS: Statistical Analysis Software.

µg/L: Micrograms per liter.

OUTLINE

Abstract

Phthalates are a family of multifunctional chemicals widely used in personal care and other consumer products. The ubiquitous use of phthalates results in human exposure through multiple sources and routes, including dietary ingestion, dermal absorption, inhalation, as well as through parenteral exposure from medical devices containing phthalates. We explored the temporal variability over three-months in urinary phthalate metabolite levels among eleven men who collected up to nine urine samples each during this time period. Eight phthalate metabolites were measured by solid phase extraction-high performance liquid chromatography-tandem mass spectrometry. Statistical analyses were performed to determine the between- and within-subject variance apportionment, and the sensitivity and specificity of a single urine sample to classify a subject's long- term average exposure. Five of the eight phthalates were frequently detected. Mono-ethyl phthalate (MEP) was detected in 100 percent of samples; mono-butyl phthalate, mono-benzyl phthalate, mono-2-ethylhexyl phthalate (MEHP) and mono-methyl phthalate were detected in over 90 percent of samples. Although we found both substantial day-to-day and month-to-month variability in each individual's urinary phthalate metabolite levels, a single urine sample was moderately predictive of each subject's exposure over three months. The sensitivities ranged from 0.56 to 0.74. Both the degree of between- and within-subject variance and the predictive ability of a single urine sample differed among phthalate metabolites. A single urine sample was moderately predictive of 3-month exposure, although the predictive ability varied across phthalate monoesters. In particular, a single urine sample was most predictive for MEP and least predictive for MEHP. These results suggest that the most efficient exposure assessment strategy for a particular study may depend on the phthalates of interest.